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STRONTIUM MINERALS FROM WISE COUNTY, VIRGINIA - AN UPDATE

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The two principal minerals containing strontium, celestite and strontianite, have been found in relative abundance in the area around East Stone Gap in Wise County, Virginia. Celestite is strontium sulfate ($SrSO_4$) and contains 56.4 percent strontium oxide. The name celestite is derived from the Latin word caelistis "of the sky" in reference to the typical blue color. Crystals are predominantly blue and zoned in color but can also be red, green, or brown. The mineral crystallizes in the orthorhombic crystal system and can form thin to thick heavy tabular crystals elongated along the b-axis; prismatic crystals elongated along the a-axis; or equant crystals elongated on the c-axis. Crystals can also have pyramidal faces with good terminations. Celestite has a high specific gravity of close to 4 and a hardness of 3 to 3.5. Cleavage is perfect parallel to the base and poor parallel to the prism.

The mineral strontianite is strontium carbonate ($SrCO_3$) and contains 70 percent strontium oxide. All the strontianite in Wise County is probably calciostrontianite where calcium content varies from 7.5 to 15 percent (Mitchell and Pharr, 1960 and 1961). However, for the sake of brevity, the mineral will be referred to as strontianite in this report. Strontianite is named for the locality at Strontian, Argyll, Scotland. Strontianite crystallizes in the orthorhombic crystal system, and in Wise County usually forms dull globular masses terminated by acicular crystals. Crystals are generally white and often can be seen as small sprays attached to the celestite crystals. The mineral has a specific gravity of 3.7, hardness of 3.5 to 4, and good prismatic cleavage.

According to R. V. Dietrich (1970) and J. A. Speer (1977), strontium minerals have been reported from seven different areas in Virginia. These localities, all in the Valley and Ridge Province, extend from Wise County in Southwest Virginia to Frederick County in the northwestern corner of the State (Figure 1). All exposures except two have been located in Upper Silurian Cayugan Age rocks (Cambrian Elbrook Formation and

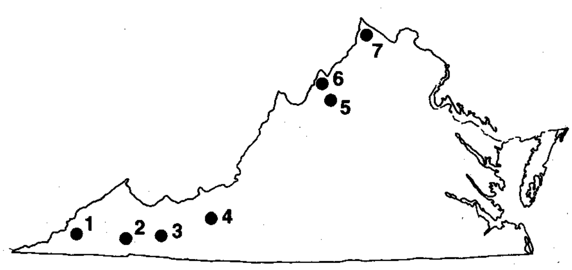

Figure 1. Strontium mineral occurrences reported in Virginia. Localities are: 1. East Stone Gap - Wise County; 2. Hayters Gap - Washington County; 3. Saltville- Smyth County 4. Dublin - Pulaski County Harrisonburg - Rockingham County 6. Fulks Run - Rockingham County 7. Hayfield - Frederick County.

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the Ordovician Athens Formation are the exceptions). The celestite occurrences in Wise County are entirely within the Hancock Limestone which is Upper Silurian. The Hancock is synonymous with the Tonoloway Limestone in northern Virginia.

Strontium minerals from Wise County, were first recognized by R. F. Pharr in 1958. Both celestite and strontianite were found in a quarry operated by G. H. Belton along State Road 613 near East Stone Gap. Since then six additional occurrences of strontium minerals have been observed by the authors in the area around East Stone Gap. This article reviews these occurrences and briefly describes the geology and varied crystal habits associated with the different sites. A brief discussion of economic considerations and some thoughts on origin are also included.

Most of the crystals described in the report and shown in the photographs can be seen at the Division of Mineral Resources building in Charlottesville.

EAST STONE GAP QUARRY

The East Stone Gap quarry in Wise County has been an active operation since the late 1960's and supplies crushed stone to local industry and lime dust for use in nearby coal mines. This quarry is approximately 2000 feet from the Belton quarry where strontium minerals were first recognized in the area.

The East Stone Gap quarry has long been noted for producing fine scalenohedral calcite crystals up to 3 inches in length with clear, sharp terminations. The authors were actually on an expedition to collect the calcite when the strontium minerals were encountered. Small, blue, tabular crystals were observed in vugs directly below the horizon in the quarry which produced the best calcite crystals. These crystals were first noted in the fall of 1980. The blue crystals were later verified by X-ray analysis to be celestite. In addition, small, white, globular masses of strontianite could often be observed attached to the celestite in the vugs. Although small calcite crystals were found associated with the celestite, the large crystals found in overlying beds were absent. Often ' ubly terminated calcite crystals were observed attached to the celestite.

A very distinct contact is evident near the quarry floor elevation between the overlying blue dense limestone and the tan brecciated dolomite which contains the celestite crystals. This overlying limestone appears to be almost devoid of vugs with crystallization. This contact marks the approximate maximum depth of excavation in the quarry because the tan dolomite is, in most cases, too soft to be used as a construction aggregate. For this reason, the quarry depth is not over 70 feet in most areas.

Hand digging in the quarry floor exposed more brecciated, vuggy areas which contained celestite. As these shallow excavations exposed celestite over a large area, it became apparent that the entire quarry floor represents the top of the dolomite host rock. Since the celestite occurs over such a large surface area, it is conceivable, given sufficient thickness and grade, that the strontium may exist in commercial quantities in the quarry. The quarry management was notified of the strontium occurrence and in the spring of 1981 expressed an interest in some preliminary development work. Consequently, four pits were excavated with a backhoe and all four revealed strontium mineralization. The distance from pit 1 to pit 4 is approximately 600 feet (Figure 2). In addition, two drill holes were completed in the vicinity of pits 2 and 3 using the quarry air-trac drill. Both of these drill holes were collared where strontium minerals were observed. However, because of the difficulty in collecting samples for analysis, the results of the drilling were inconclusive. Any further drilling on the site should be done with a core drill, so that the core can be studied and split for detailed analysis.

As stated previously, all production from the quarry is from the upper 70-80 feet of

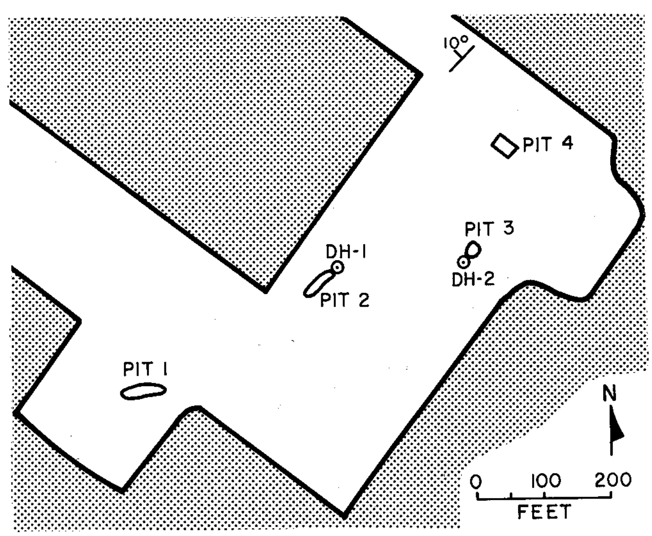

Figure 2. Locality 9 at the southeastern end of the East Stone Gap quarry. Four pits were excavated into the quarry floor. Strontium minerals occur in each pit. The Devonian Wildcat Valley Sandstone (5-10 feet) caps the outer quarry walls. (DH denotes drill hole.)

the Hancock Limestone. Strontium mineralization was not observed in this upper horizon. Approximately 10 feet of highly weathered and fossiliferous Wildcat Valley Sandstone forms the quarry rim above the Hancock. Much of the sandstone has been weathered from the rim and good fossils can often be found near the base of the highwall in the quarry. The generalized geologic column shown in Figure 3 depicts conditions as they exist in the quarry. The strata within the quarry generally strike N40°E and dip 10°NW.

The celestite from the quarry has a wide range of crystal habits, including:

1. very thin, tabular, almost bladelike crystals up to 0.2 inches in length colorless to light blue in color (Figure 4).
2. white to pale blue tabular crystals (thicker than 1); some crystals occur in clusters (same size as 1).

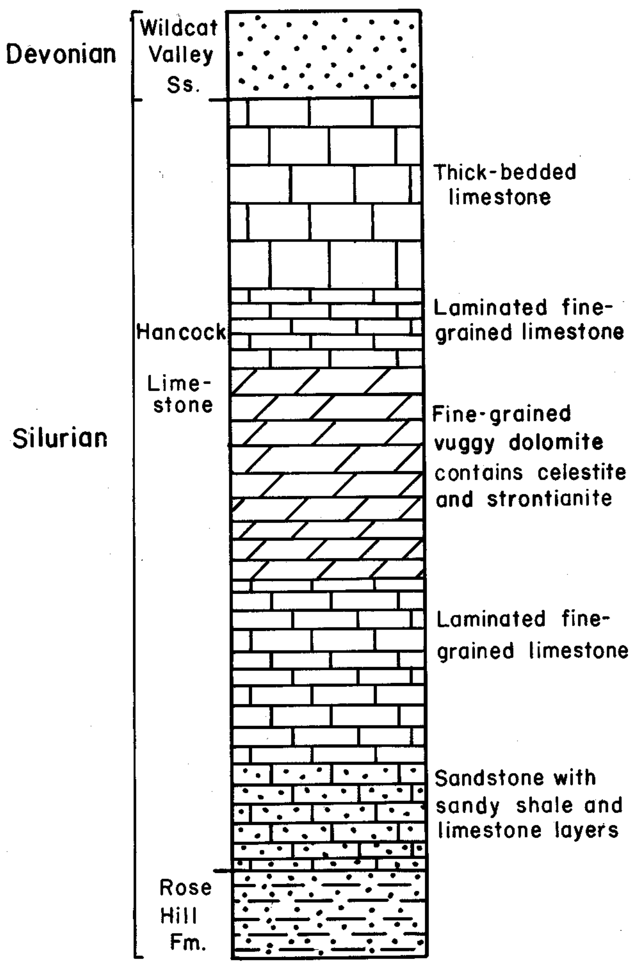

Figure 3. General stratigraphic section of the Hancock Limestone in the East Stone Gap quarry and vicinity. Strontium minerals occur in the vuggy dolomite in the middle of the limestone.

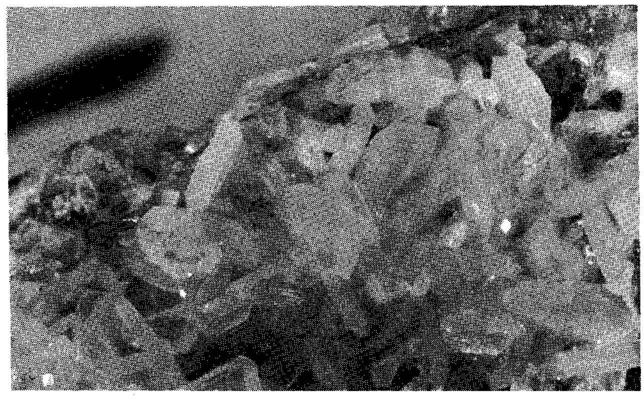

Figure 4. A group of clear light blue tabular celestite crystals. Largest crystals 0.2 inch. Etching seen on large crystal may represent beginning of alteration to strontianite. Specimen is 2.5 inches in length (pit no. 4).

3. pale blue, blocky crystals to 0.5 inch in length; some show double terminations.
4. colorless, gray or pale blue to medium blue prismatic crystals to 1 inch in length.
5. prism-like celestite crystals with pyramidal faces up to 1 inch in length. Some have excellent blue color; the best samples are from pit 4 in quarry (Figure 5).
6. Equant crystals which are usually gemmy and have excellent blue color. (up to 0.2 inches in diameter).
7. Amber colored scalenahedral calcite crystals on tabular celestite crystals (Figure 6).

Many crystals show etching and color banding or zoning. Rarely, celestite occurs as massive cross-fiber vein filling in the dolomite and can be especially noted in pit 3 in the quarry. As mentioned previously, strontianite and calcite are often found associated with the celestite. Other minerals noted during the study were minor fluorite and pyrite.

Figure 5. An exceptional prism-like celestite crystal with pyramidal faces. The crystal, which is 0.8 inch in length with good blue color, was found in the East Stone Gap quarry (pit no. 4).

Figure 6. A vug in dolomite showing amber colored scalenohedral calcite crystals (largest 0.7 inch) on tabular celestite crystals. Some celestite has smaller calcite crystals attached, (East Stone Gap quarry - pit no. 1).

STRONTIUM LOCALITIES

Because of the abundance of strontium minerals in the East Stone Gap quarry, the authors searched elsewhere in the area and found five additional sites containing strontium minerals. A generalized geologic map is shown on Figure 7 which shows the location of these occurrences.

It should be noted that all the sites are located on private property and permission must be obtained prior to entrance.

Site 1 Hancock Limestone (N87°W 20°NE) - approximately 15 feet of thin-bedded dark gray dolomite in a roadcut near the Big Stone Gap city limits on old U. S. Highway 23. Abundant masses of acicular strontianite, along

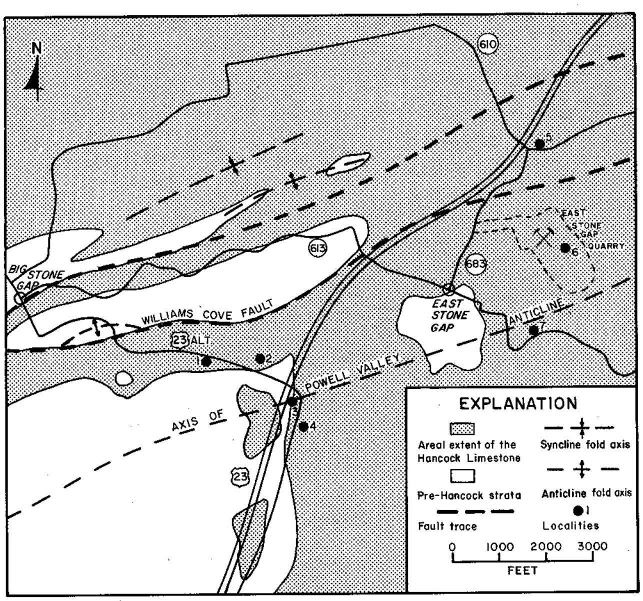

Figure 7. Generalized geologic map showing known occurrences of strontium minerals in Wise County (after Miller, 1965).

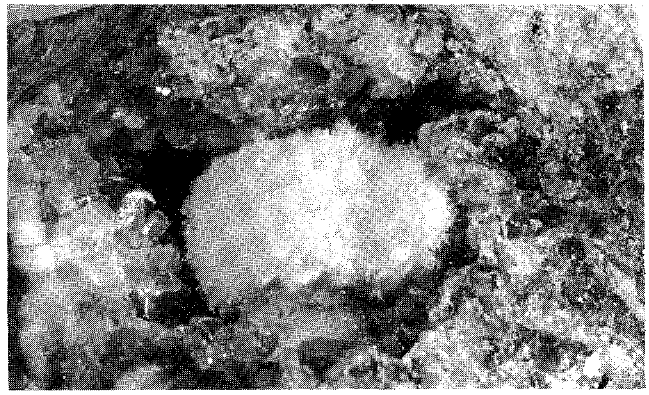

Figure 8. Vug in dolomite showing white globular mass of strontianite. Mass measures 0.4 inch x 0.6 inch and is terminated by small acicular crystals (site no. 1).

with highly etched colorless calcite crystals, line vugs in the dolomite. No celestite was observed. The extent of etching indicates strontianite is secondary after celestite (Figure 8).

Site 2 Hancock Limestone - approximately 3 feet of thin-bedded dolomite exposed in a small dirt roadway 1200 feet east of site 1. A single etched celestite crystal was found at about the same stratigraphic interval as site 1. Strontianite was not observed. Wildcat Valley Sandstone caps the hilltop approximately 80 feet above the outcrop.

Site 3 Hancock Limestone (N55°W 10°NE) - 10 feet of light to medium gray dolomite in the roadcut for the Big Stone Gap exit ramp off new U. S. Highway 23, 3200 feet east of Big Stone Gap city limits. Very small globular masses of acicular strontianite with abundant small calcite crystals occur in vugs in the dolomite. No celestite was observed by the authors; however, celestite crystals collected by others from this site have been examined.

Site 4 Hancock Limestone (N18°W 11°NE) - thin-bedded gray to brown dolomite in an excavation 500 feet southeast of site 3. Abundant celestite and strontianite were observed in vugs in the dolomite. The vugs are nodular in appearance and may represent replacement of anhydrite nodules by strontium minerals. Dark blue celestite crystals up to 3 inches in length were found in one cavity along with strontianite masses 1 inch in diameter.

Site 5 Hancock Limestone - a single tabular, colorless celestite crystal (0.1 inch in length) was found in a vug lined with small colorless calcite crystals. The dolomite in this roadcut is poorly exposed due to vegetation.

Site 6 East Stone Gap quarry, Hancock Limestone - previously described.

Site 7 Belton quarry - Hancock Limestone - this old quarry just east of East Stone Gap was the first reported occurrence of strontium minerals in Wise County (Pharr and Mitchell, 1959). At the time Pharr and Mitchell examined this quarry, operations had already ceased and only a few etched celestites and a few specimens of strontianite were observed in vugs in the flat-lying dolomite. A recent examination of this quarry reveals vugs with calcite crystals but little evidence of strontium minerals. The strontium minerals appear to be susceptible to weathering and most of the vugs are almost hollow with only shattered remnants remaining.

GEOLOGY

The Upper Silurian Hancock Limestone underlies much of the pre-Pennsylvanian area of Wise County (Figure 7). The Hancock Limestone is mainly composed of thin-bedded magnesian limestones and dolomites with a few thin sandstone beds at the base of the formation (Figure 3).

The limestone, which is approximately 200 feet thick, overlies the shales, siltstones, and sandstones of the Silurian Rose Hill Formation and underlies the highly fossiliferous Wildcat Valley Sandstone (Devonian). This sandstone caps many of the small knobs and ridges in the study area. The Wildcat Valley Sandstone, which has a calcium carbonate cement, is generally deeply weathered, leaving a residue of very sandy soil containing abundant silicified fossils. Numerous brachiopods, rugose and tabular corals, bryozoa, and crinoid columnals were observed in the weathered rock which forms the rim of the East Stone Gap quarry. On the other hand, the Hancock Limestone in the area is generally non-fossiliferous and was probably formed in tidal environment.

Celestite and strontianite are found in vugs, fractures, veins, and nodules in thin dolomites near the middle of the Hancock Limestone. To date, all strontium mineralization has occurred within this dolomite horizon. Two primary areas of concentration have been defined at this time, one at the intersection of new U. S. Highway 23 and old highway 23 near Big Stone Gap and the second area northeast of East Stone Gap at the old Belton quarry and the active East Stone Gap quarry.

The axis of the Powell Valley anticline dissects the area with strata ranging from horizontal to a dip of 10° along the axis up to a dip angle of 70° at the fault intersection. The two major areas of strontium concentration appear to be directly related to the axis of the Powell Valley anticline where dips are low. This fault is an extension of the zone mapped as the Williams Cove fault on the geologic map of the Big Stone Gap quadrangle (Miller, 1965).

THOUGHTS ON ORIGIN

Because this report is preliminary in nature, only brief remarks will be made concerning the origin of the strontium minerals. Strontium exists in seawater to the extent of 8 mg per liter (Fairbridge, 1972). According to Rankama and Sahama (1950), the bulk of strontium is separated from brines in a shallow water environment and goes into anhydrite and polyhalite. Both minerals ordinarily contain strontium; in fact, celestite is almost always associated with anhydrite. In the Wise County deposits, celestite was probably formed in vugs as a replacement of the anhydrite nodules. A similar origin for celestite in Frederick County was proposed by Rogers (1965). Large nodules (up to 20 pounds) containing celestite were noted at site 4 and pit 4 in the East Stone Gap quarry. Adding strength to this possibility is the fact that X-ray diffraction prints show prominent anhydrite peaks associated with the celestite.

Celestite is also very often associated with the remains of marine organisms which originally built shells consisting of aragonite. When aragonite is converted into calcite, strontium is set free and may migrate as a sulfate (celestite). This could be evidenced by celestite occurring directly adjacent to the horizon in the quarry containing abundant calcite.

The occurrence and texture of strontianite suggests that it is secondary after celestite. This may be because of the effect of carbonic acid on celestite. Some samples show this alteration process well with small calcite crystals attached to celestite crystals which are beginning to alter to strontianite. Most celestite crystals which have undergone this process show a large degree of etching. One specimen from site 4 shows the complete cycle with blue celestite, etched calcite turning white, and finally complete transformation into strontianite.

ECONOMIC CONSIDERATIONS

Currently, the major use of strontium is in the manufacturing of glass for color television tubes. The strontium acts as a radiation shield blocking secondary X-ray emissions. The second most important use is in pyrotechnics and signals such as flares and tracer ammunition. Strontium has the ability to impart a brilliant crimson color to a flame. In addition, ferrite-ceramic permanent magnets containing strontium are used in electric motors that are lighter, more compact and cheaper than those using metal field electromagnets. Strontium carbonate is used in the production of high purity electrolytic zinc. Although metallic strontium is not used to a very large extent, the use of lead-strontium alloys in maintenance-free storage batteries may lead to an increased demand for the metal. At the present time, there are no satisfactory substitutes for the major uses of strontium compounds.

Although the economic potential of the Wise County deposit has not been evaluated at this time, there are several important factors to be considered:

1. Over most of the study area the deposit either crops out or underlies a relatively thin cover of the upper Hancock Limestone and the Wildcat Valley Sandstone. In the East Stone Gap quarry proper, all strata overlying the mineralization has been stripped off, leaving the entire zone exposed with no overburden to contend with.
2. The strontium mineralization occurs in an area of well developed transportation systems including four-lane highway (U. S. Highway 23) and nearby railway facilities.
3. The United States has depended on foreign sources for its celestite supply since 1959, with no domestic production during that period. Large deposit of high grade strontium minerals in several foreign countries have inhibited the development of domestic resources. The U. S. is currently importing 99 percent of its celestite from Mexico. (U. S. Bureau of Mines, 1983).
4. A processing facility which buys strontium minerals and produces strontium compounds is located in Cartersville, Georgia.
5. Since the quarry is operating at the present time, handling equipment and crushing facilities are functioning and would be available if needed for development work.

For a better understanding of the deposit detailed geologic mapping of the immediate area should be completed with strong emphasis on the Hancock Limestone and accompanying mineralization. In addition, further trenching and drilling in the East Stone Gap quarry should be done to determine if commercial amounts of strontium are present. This quarry presents an excellent opportunity to study a relatively unique deposit. Additional information on the economics of strontium minerals can be found in Taylor, 1980.

ACKNOWLEDGEMENTS

The writers would like to express their thanks to Myron Salyer, Richard S. Mitchell, Shirley Pearson, Palmer Sweet, Ollie Fordham, Tom Gathright, and Louis Valente who assisted with various aspects of this report. Thanks should also be extended to the East Stone Gap quarry management who offered their personnel and equipment freely toward developing a better understanding of the deposit.

REFERENCES

Dietrich, R. V., 1970, Minerals of Virginia: The Williams Printing Co., 325 p.

Fairbridge, R. W., 1972, Encyclopedia of geochemistry and environmental sciences: Van Norstrand Reinhold Co., 1321 p.

Goldschmidt, V. M., 1954, Geochemistry: Oxford, Clarendon Press, 730 p.

Miller, R. L., 1965, Geologic map of the Big Stone Gap. quadrangle, Virginia: U. S. Geol. Survey Quadrangle Map GQ-424.

Mitchell, R. S. and Pharr, R. F., 1960, Strontium minerals from Wise County, Virginia: Virginia Division of Mineral Resources, Virginia Minerals, vol. 6, no. 4, p. 1-4.

Mitchell, R. S. and Pharr, R. F., 1961, Celestite and calciostrontianite from Wise County, Virginia: American Mineralogist, vol. 46, p. 189-195.

Pharr, R. F. and Mitchell, R. S., 1959, Celestite and strontianite from Wise County, Virginia: Virginia Jour. Science, vol. 10, p. 295.

Rankama, K. and Sahama, Th. G., 1950, Geochemistry: University of Chicago Press, 912 p.

Rogers, W. H., 1965, Celestite from the Tonoloway Formation at Hayfield, Frederick County, Virginia: Master's, Univ. of Virginia.

Sinkankas, J., 1964, Mineralogy: Van Norstrand Reinhold Co., 585 p.

Speer, J. A., June, 1977, The orthorhombic carbonate minerals of Virginia: Rocks and minerals (special Virginia issue), vol. 52, no. 5, p. 267-274.

Taylor, H. A., 1980, Mineral facts and problems: U. S. Bureau of Mines Bull. 671, p. 869-876.

U. S. Bureau of Mines, 1983, Mineral commodity summaries: Washington, D. C.

FARMVILLE LITHIA SPRINGS

Bob Flippen

Mineral water springs were a popular component of American life in the nineteenth and early twentieth centuries. The water was often bottled and distributed both locally and to distant points. Although most springs were short-lived, some were integrated into the routine of local residents by providing recreation; "going to the springs" became a frequently used and understood expression in the local lexicon. (Figure 1).

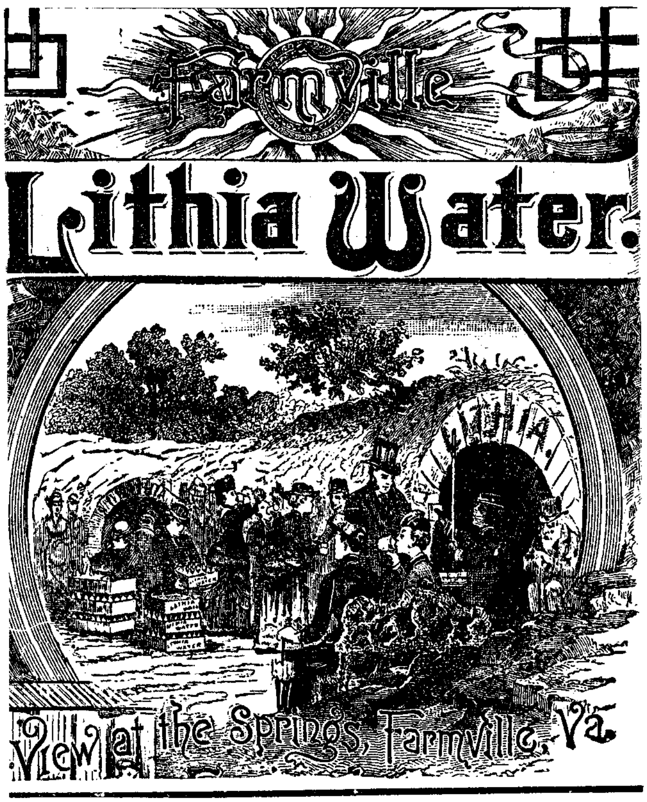

Figure 1. Letterhead showing scene at Farmville Lithia Springs about 1890 (coutesy of Ottie Baker).

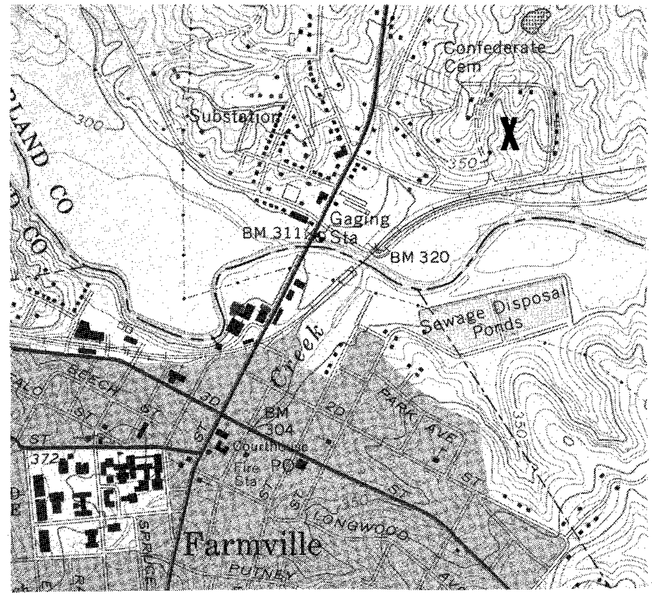

Figure 2. Locality map of the Farmville Lithia Springs. Spring location shown by X on map.

Figure 3. Arched brick and cement spring cover for Farmville Lithia Spring Number 2 (photo courtesy of Ottie Baker).

Such a spring resort existed near Farmville, Virginia (Figure 2). For almost seventy years the waters from the springs were bottled and sold throughout the nation. Guests were accommodated in the nearby Houston home for the duration of their treatment with the water. Today, all but forgotten, more than twelve arched brick and cement spring covers stand in mute testimony to what was once a popular enterprise (Figure 3).

A very important source of information for this paper was the author's personal communications with Elizabeth Baker (formerly Elizabeth Lee Thackston). Mrs. Baker was the last owner of the Farmville Lithia Springs prior to the closing of the operation in 1945, and was helpful in describing the early history of the Springs. She died in December of 1980, at the age of 96. In addition to Mrs. Baker, Jack Osborn, the present owner of the "old" lithia springs property, was most helpful in pointing out structural remains of buildings associated with the Springs.

WHAT IS LITHIA WATER?

As rainwater strikes the earth's surface, it dissolves some minerals found in the earth's crust. The dissolved constituents in the water gradually increase as the water infiltrates through the different rock strata eventually yielding mineral water in some areas. Rock in the area of the Farmville springs is biotite-gneiss intruded by granite and pegmatite. The Farmville Triassic basin is located less than one-half mile west of the springs. The exact source of the lithium is unknown; it is probably absorbed by groundwater from partially weathered granitoid rocks in which the springs are located (G. P. Wilkes, personal communication, 1983).

In the medical acceptance of the term, a mineral water is one which by virtue of its ingredients, whether mineral, organic, gaseous, or the principle of heat, is especially applicable to the treatment of disease (Walton, 1883).

Lithium is but one element commonly found in mineral waters. It was discovered in 1817 by the Swedish chemist Johann August Arfvedson, but it was not until 1855 that lithium was isolated in a measurable quantity by Robert von Bunsen and Augustus Matthiesen using electrolysis. Lithium is but one element commonly found in mineral waters. Lithium is usually found in a chloride or sulphate, but sometimes it is found in the form of a carbonate. The first two salts occur in saline or alkaline waters, whereas the carbonate is found in alkaline waters only (Goosman, 1906). Lithium carbonate (Li_2CO_3), is only sparingly soluable in water, but when exposed to carbon dioxide the bicarbonate of lithium ($LiHCO_3$) is formed which is freely soluable giving the solution referred to as lithia water.

The use of mineral waters in the treatment of disease is called hydrotherapeutics. Walton felt that mineral waters were only applicable in the treatment of chronic diseases and that the appropriate time for their application was during the inactivity of the disease. However, Walton said that this does not apply to all chronic disorders, for some present no intervals of dormancy.

Consumption was probably the most popular method of administering mineral waters. Bathing, or balneology, was also popular but was practiced more in warmer or hot springs. Mineral waters were also used in the production of soft drinks; while waters of a lithia or potash compound were taken almost entirely medicinally (Mitchell, 1913).

The widespread use of mineral waters in this country may be attributed to a lack of safe drinking water. Well construction was not as sophisticated then as it is now, and the water quality in cities tended to deteriorate as the existing water was polluted by increased population. The medical claims of mineral waters are contestable. The benefit derived was probably not by virtue of a dissolved ingredient, but rather by cleansing the digestive system with uncontaminated water.

Dr. William Back, a water chemistry hydrologist at the United States Geological Survey, agreed with the purification effect produced in the course of consumption and added that some waters contained trace elements deficient in some individuals. The average person, unable to diagnose his specific disorder, would often try different waters before finding one that offered relief.

Eventually, the mineral and vitamin pill was produced and marketed; with it came a new convenience that inadvertently destroyed the mineral water trade. In the 1920's a gallon bottle of Farmville lithia water bought in Chicago cost seventy-five cents. The directions strongly encourage drinking six to eight glasses a day. So obviously, vitamin and mineral tablets became more economically appealing and the inconvenience of regular periodical drinking was altogether averted. Ultimately, spring waters and their accompanying resorts declined in popularity and use (Back, personal communication, 1981).

Today, medical science uses lithium carbonate in the treatment of manic depression. The crystalline salt is used during an acute manic or depressive phase. The dosage of lithium carbonate must be carefully supervised by a physician as even a slight overdose can have toxic effects (Bressler, 1981).

Beyond the therapeutic function of springs, was a more human element of the watering place. It served as a gathering place for people to relax in local communities. Mineral waters were fashionable in the nineteenth century and lithia springs held a prominent place in the last three decades. For the most part, springs contained only a small amount of lithium (Table). However, that the water contained lithium, even in trace amounts, was usually expressed in the name given the spring (Peale, 1888).

The springs near Farmville, Virginia were no exception. Burrell (1922) suggests that these springs were frequented by the Indians, as evidenced in the unearthing of charcoal and projectile points during early con-

Table. Chemical analyses of selected spring waters in Virginia.

Spring Name and Location in Virginia	Lithium Composition Grains per gallon
Allegheny Springs, Montgomery County	lithium carbonate------trace
Antidyspeptic and Tonic Springs, Nottaway County	lithium---------------trace
Bath Alum Springs, Bath County	lithium sulphate-------trace
Bear Lithia Springs, Rockingham County	lithium chloride-------trace
Bedford Alum, Iron and Lithia Springs, Campbell County	lithium sulphate-------trace
Blue Ridge Springs, Botetourt County	lithium chloride-------trace
Buffalo Lithia Spring No. 2, Mecklenburg County	lithium bicarbonate----trace
Cold Sulpher Spring, Rockbridge County	lithium chloride-------trace
Colemanville Mineral Springs, Cumberland County	lithium bicarbonate----trace
Crockett Arsenic Lithia Spring, Montgomery County	lithium carbonate------trace
Glenola Springs, Nottaway County	lithium carbonate------trace
Hunter's Pulaski Alum Springs, Pulaski County	lithium sulphate-------trace
Iron Lithia Spring, Tazewell County	lithium chloride--------0.18
Massanetta Springs, Rockingham County	lithium carbonate------trace
Nye Lithia Spring No. 1 Wythe County	lithium carbonate-------6.41
Rockbridge Alum Spring, Rockbridge County	lithium sulphate--------0.02

(Analyses compiled from: Crook (1899).

struction. The early advertising of the Springs' supposed healing powers was done by word of mouth. Residents of Farmville visited the Houstons to view the Springs and consume the water themselves. In the flurry of activity that ensued, the owner of the Springs, an entrepreneur as evidenced in his earlier managing of the Farmville Coal Mines and tobacco trade, probably saw the profit to be derived from the development of the property.

On August 24, 1884, The Farmville Lithia Springs were incorporated in accordance with the laws of the Commonwealth of Virginia. Arched covers of brick and cement were placed over each spring, and bottling house was constructed near the present intersection of Early Street and Virginia Highway 45.

The water was diverted from the springs to the bottling houses via a pipeline that utilized gravity. Here, the water flowed into a large galvanized tub where bottles and demijohns were filled underneath by faucet. The filled containers were then loaded and transported to the railroad depot in Farmville. (Figures 4 and 5). Here, 532 five-gallon demijohns were placed in a box car and sent to St. Louis and later,

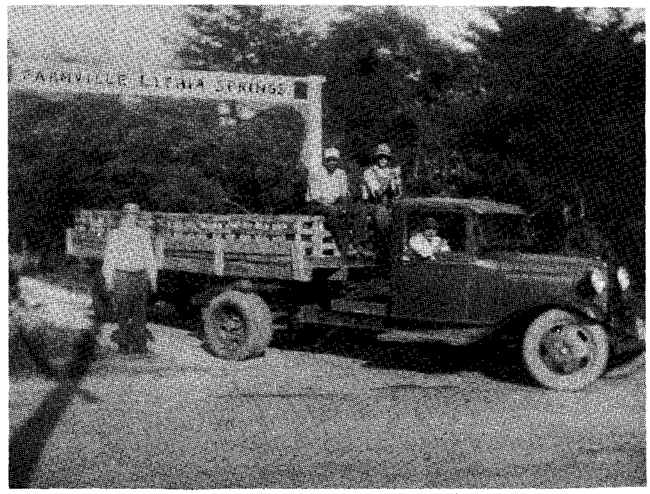

Figure 4. Load of Farmville lithia water ready to be transported to the railroad depot (photo courtesy of Ottie Baker).

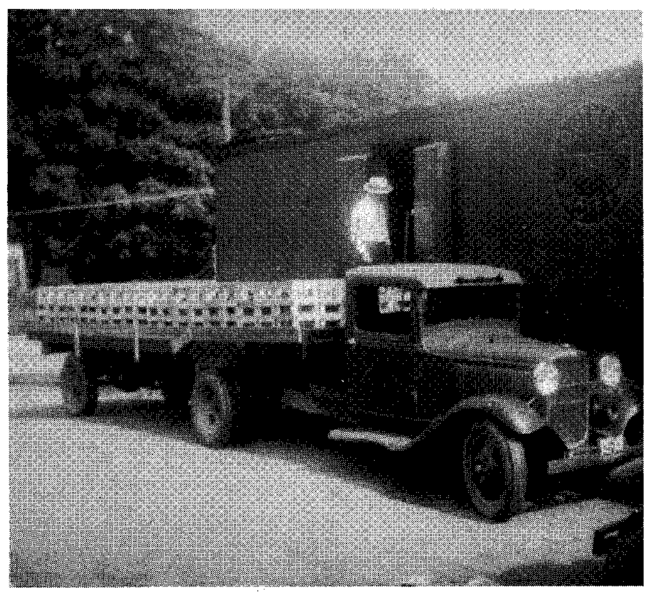

Figure 5. Demijohns in the process of being loaded onto a railroad boxcar bound for Chicago (photo courtesy of Ottie Baker).

Chicago. The water was then put in smaller serving bottles and labeled (Figures 6 and and 7).

Shortly after 1945, the business venture deteriorated. It was marked by a decline in advertising, local deliveries, and the failure of attempts to have a hotel constructed. Eventually, a dispute over the lithia springs property left the original cluster a struggling enterprise which later folded.

Figure 6. Label used on bottles of Farmville lithia water.

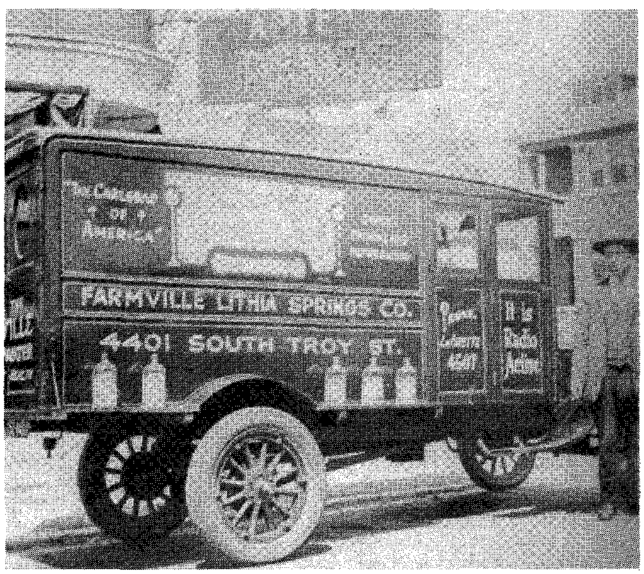

Figure 7. Farmville-lithia-water distribution truck in Chicago (photo courtesy of Ottie Baker).

REFERENCES

Bressler, R., 1981, Physicians' drug manual: Garden City, N. Y.

Crook, J. K., 1899, Mineral waters of the United States and their therapeutic uses: New York, Lea Bros.

Goosman, J. C., 1906, Carbonic acid industry: Chicago, Nickevson and Collins Co.

Mitchell, C. A., 1913, Mineral and aereated waters: New York, D. van Nostrand Co.

Peale, A. C., 1888, Classification of American mineral waters: Philadelphia, William J. Dorman.

Walton, G. E., 1883, Mineral waters of the United States and Canada: New York, D. Appleton and Co.

VAS SYMPOSIUM TO BE HELD

A symposium on the tectonics and stratigraphy of Virginia commemorating the work of the late Leonard D. Harris (Virginia Minerals, 1982, vol. 28, no. 4) will be held by the Geology Section of the Virginia Academy of Sciences at George Mason University on May 20.

Mr. Harris, a geologist with the U. S. Geological Survey at the time of his death, did extensive geologic studies in Virginia and his innovative work in seismic stratigraphy and structural geology is known throughout the international geologic community. His most recent work in the state was on completion and interpretation of a seismic line from Staunton to Norfolk. Mr. Harris received the Meritorious Service Award from the Department of the Interior in 1981.

PUBLIC HEARINGS ON ENVIRONMENTAL CONCERNS

Four public hearings on environmental concerns in Virginia are scheduled in May. They will be held at 7:30 P.M. as follows:

May 10, Abingdon-General District Courthouse
May 11, Danville-City Council Chambers
May 18, Newport News-City Council Chambers
May 19, Arlington-County Board of Supervisors Chambers

For more information contact: Virginia Council on the Environment, 903 Ninth Street Office Building, Richmond, VA 23219, Phone: 804/786-4500.

SCHEDULED MEETINGS

May 13-20, Paleozoic stratigraphy and Appalachian Basin, field seminar, Arlington, Virginia (John Dennison, Dept. of Geology, University of North Carolina, Chapel Hill, N.C. 27514).

May 17-20, Virginia Academy of Science, George Mason University, Fairfax, Virginia (S.O. Bird, Division of Mineral Resources, P.O. Box 3667, Charlottesville, VA 22903).

June 26-28, Mid Atlantic Industrial Waste Conference, Lewisburg, Pennsylvania. (Michael LaGrega, Dept. of Civil Engineering, Bucknell Univeristy, Lewisburg, PA 17837 Phone: 717/524-1492 or 717/524-1112).

August 7-12, Fossil Coral Symposium, Washington, D.C. (Symposium on Fossil Cnidaria, E-501 Natural History Building, Washington, D. C. 20560).

October, 30/November 3, Society of Exploration Geophysicists, Washington, D.C. (John Hyden, SExG headquarters, Box 3098, Tulsa, OK 74101).

December 5-7, Chesapeake Bay Conference, George Mason University, Fairfax, Virginia (Council on the Environment, 903 Ninth Street Office Building, Richmond, VA 23219 Phone: 804/786-4500

ANNOUNCEMENT

Due to the recent death of Mr. Crawford Keener, the Rutherford mine near Amelia Court House has been temporarily closed to mineral collectors.

MINERAL RESOURCES

According to the U. S. Bureau of Mines, nonfuel mineral production in Virginia dropped from 283 million to 272 million dollars in 1982. The value of lime production dropped 4 million dollars and the value of sand and gravel increased 4 million dollars. With New Jersey Zinc Company closing its operation before the beginning of the year, almost 11 million dollars of lead and zinc production was lost in 1982.

The State moratorium on uranium mining and processing has been extended until July 1, 1984. Extensive studies will be carried on in Pittsylvania County by both industry and independent experts over the next 18 months.

Interest continues in the Gold-pyrite belt in the Virginia Piedmont province. Callahan Mining Corporation will continue their drilling program in Orange County in 1983. Walnut Creek Mining Company's panning operation opened in April.

Luck Stone Corporation of Richmond has begun construction on the entrance road to their new quarry site north of Ruckersville, Greene County. The quarry will produce crushed stone up to a production limit of 800,000 tons a year.

Palmer C. Sweet

OIL AND GAS NEWS

While the price of oil has declined because of worldwide surplus, lower oil company profits have in many cases been offset by the decline in the costs of drilling a well. Companies with a greater cash flow are in the best position to take advantage of this situation.

Drilling for oil or gas has taken place in the Chesterfield County portion of the Richmond Triassic basin over the past few years. Merrill Natural Resources has drilled twelve wells, two of which gave encouraging signs of oil and gas but not in commercial quantities. Southeastern Exploration and Production of Dallas plans further drilling in Chesterfield County. Only in rare instances has a continental-type deposit such as the Richmond basin yielded hydrocarbons in commercial quantities.

Nine hundred square miles of offshore lands located from 8 to 85 miles off the Virginia coast and east of Wallops Island will be declared off limits for drilling companies. The area is to be used as a rocket testing area by NASA.

A new type of drill bit for soft to medium-hard formations has been introduced by several companies in their quest for increased drilling speed. Called the diamond blank or shear bit, its cutting surfaces are a series of compacts composed of diamonds set in a carbide matrix. While drilling speed has been greatly improved over the carbide insert tri-cone bit, the cost of this new bit is much greater.

The carbide insert tri-cone drill bit has undergone some changes that have increased its performance. This change has involved the elimination of the roller bearings inside the cones. The roller bearings have replaced by an enlarging of the journal bearing. Roller bearings in bits below 12-1/4 inches have always been one of the weak points of the tri-cone insert drill bit because inward thrust coupled with cuttings entering the roller race eventually cause the roller bearings to wear "egg shape" resulting in locking the cones, skidding, and bit destruction.

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NEW PUBLICATIONS

PUBLICATION 39

The "Bibliography of Virginia Coal" was compiled by G.P. Wilkes and James A. Henderson, Jr. in an effort to organize the tremendous amount of information published about coal resources in Virginia. The 18-page publication contains a subject index and approximately 400 references listed by the author's name. Cost for this publication is $3.00 plus a four percent sales tax for Virginia addresses; postage will be billed.

PUBLICATIONS 40 AND 41

Two new publications about the Culpeper basin north-central Virginia are now available which describe the radioactive and magnetic features of rocks there. This information was obtained from airborne surveys. Each report consists of a large single sheet two-color map with accompanying descriptive text.

Publication 40 by Brian Leavy, Andrew Grosz and Stanley Johnson is entitled "Total-Count Aeroradiometric Contour Map of the Culpeper Basin and Vicinity." Regional values for uranium, thorium, and potassium are shown on a planimetric base map of the area from Barboursville, Orange County, northeastward to beyond Leesburg, Loudoun County. The positions of Triassic and Jurassic age igneous and sedimentary rock types are shown together with their radiometric values. This report is useful to assist in positioning subsurface rocks and as baseline data on radioactivity.

The "Aeromagnetic Contour Map of the Culpeper Basin and Vicinity", Publication 41, is by Stanley Johnson and A. J. Froelich. Regional magnetic values are shown of the same area as for the aeroradiometric survey. Rock types are shown with their contoured magnetic values. The positions of igneous rocks in the basin and of geologic units beneath it can be interpreted from this report.

The publications can be ordered from the Division for $5.00 each. Add four percent for in-State orders; postage will be billed. The surveys were funded and prepared in cooperation with the U. S. Geological Survey.

PUBLICATION 42

Publication 42, entitled "Stratigraphic Cross-Sections for the Upper Mississippian-Middle Pennsylvanian Units of Buchanan and Dickenson counties Southwest Virginia", was compiled by M. L. Mitchell, M. S. Morris, J. K. Polzin, J. E. Nolde, and J. H. Grantham. The data used in constructing the cross-sections was taken from gas well logs, coal mine maps, existing geologic maps and current in-progress mapping activities. Geologic rock units, shown on the map and mentioned in the included text are: Bluestone, Pocahontas, Lee, Norton, and Wise formations. The cross-sections show the relationship between stratigraphy, structure, and topography in the region. These cross-sections can be ordered from the Division for $7.50 plus a four percent sales tax for Virginia addresses; postage will be billed.

1983 LIST OF PUBLICATIONS

The Division's new 1983 List of Publications can now be obtained without charge. The booklet indicates maps and over 250 different publications pertaining to Virginia's rocks, minerals, and fossils.